Retaining device for a cable

The present invention relates to a retaining device for a cable, comprising a drum for containing at least two windings of the cable on the casing face thereof, said drum being mounted on bearings such that it can rotate. A retaining device of this type is generally known in the state of the art. With a rotating drum a cable can be pulled tight or paid out again. Such drums are used in particular in shipping, such as on tugs or other vessels.

When the cable is under tension and when paying out thereof, high 'pinching forces' with respect to underlying cable are produced in the cable wound around the drum, which forces reduce the strength and life of the cable.

In view of the relatively large diameter of the drum (and thus long stretch of outgoing cable) high forces are needed to hold the cable under full load and also to pull the cable. This means that the brake/locking system (and to a lesser extent the drive motor) for the drum have to be of corresponding heavy construction so as to be able to apply a high force to the cable, which translates to a high torque via the diameter of the drum. The diameter of the drum is determined by the diameter of the cable. Cables may be subjected to only limited bending. If bending is too great there is an appreciable loss of strength and damage to the cables occurs in the long term.

The aim of the present invention is to provide a retaining device for a cable with which it is possible to apply a high retaining force, that is to say a high torque, to the drum using a relatively small brake/locking system and a simple drum. On the other hand, it must be ensured that sufficient movement of the cable can be achieved with the drum.

This aim is achieved with the retaining device described above in that the distance from the casing face of said drum to the axis of rotation of said bearings varies around the periphery of said drum.

According to the present invention the centre of the drum is no longer coincident with the axis of rotation of the drive thereof. As a result the casing face of the drum with which the cable comes into contact will be alternately closer to and further away from the axis of rotation. The highest retaining force can be exerted on the cable at the point in time when the axis of rotation is closest to the casing face. This force is lowest at the point in time when the casing face is furthest away from the axis of rotation. What can be achieved by this eccentric arrangement is, on the one hand, that optimum retaining force is provided by appropriate choice of the point where the cable is engaged and, on the other hand, it is

guaranteed that there is adequate winding/unwinding speed. In this way a relatively small brake/locking system (that can comprise the drive motor) can suffice. Restriction of the size of the brake/locking system is essentially dependent on the reduction in the distance from the axis of rotation to the casing face. More particular the axis of rotation is within the shell circumference of the drum but deviates from the center of said drum.

In a particular embodiment it is found that the capacity of the brake/locking system can be reduced by more than a factor of ten. As a result it is possible to start from a completely modified, highly simplified construction.

If the distance from the casing face to the axis of rotation of the drum is particularly small there will be no or hardly any moment when pulling. Paying out of the cable then has to be achieved by positive driving of the drum by turning it using a motor. As a result, the distance after which the movement continues by itself also increases. Positive driving can, however, also be implemented by means of a mechanism or lever.

In all cases, the drum will be able to reach appreciable speeds of rotation when paying out. In principle, imbalance is produced as a result of the eccentric construction. According to the present invention, this imbalance is removed by providing balancing, for example by fitting additional weights. By fitting these weights as far as possible at the outer periphery, the moment of inertia is also increased.

A significant advantage of this rotary construction is that when paying out the cable moves together with the supporting surface under high load (no slip) and produces no wear on the two surfaces.

According to an advantageous embodiment of the invention, at least one location on the periphery of the casing face is essentially coincident with the axis of rotation of said bearings. Essentially must be understood to mean that there can be some distance because of the diameter of the drive shaft.

According to an advantageous embodiment of the invention, preferably when used on tugs with towing installations that can rotate 360° in the horizontal plane, the axis of rotation will preferably be essentially vertical. As a result it is possible to achieve a low installation height, in contrast to conventional winches with horizontal axes of rotation, while nevertheless the cable is subjected to slight bending (large drum diameter).

According to a further advantageous embodiment the casing face is cylindrical and more particularly circular cylindrical. In order to increase the retaining force on the cable, grooves are made on (a part of) the casing face to accommodate the cable. When such

grooves are used, the retaining force can be increased to a higher percentage of the tensile strength of the cable. Up to 95 % of the breaking strength of the non-bent cable has been found possible when an optimum diameter of the drum is chosen.

According to a further advantageous embodiment the surface of the casing face is made rougher or provided with other materials with a higher coefficient of friction to make the friction between the casing face and the cable greater. As a result, all force is transmitted per winding and fewer windings on the drum can suffice.

According to a further advantageous embodiment the drum consists of an eccentric part and of a centric part, a guide system being able to guide the cable from the one part to the other. With this arrangement it is possible to guide the cable on the centric part when hauling in and paying out and to direct the cable around the eccentric part only when holding. The separation between these parts can be constructed as a partitioning board provided with an opening 10 - 25 % of the circumference in size.

According to a further advantageous embodiment the drum is not only constructed as a retaining device for the cable but also as a store. In this case the part for storage of the cable would usually be positioned centrically with respect to the axis of rotation. In general, a separate part of the drum that is above or below the retaining device will be used for this purpose.

The invention also relates to a winch system where storage of the cable is separated from the retaining device. This storage is some distance away and can be effected in a wide variety of ways, including storage on a single drum, storage around a system of several drums, stored in storage system, etc.

The invention will be explained in more detail below with reference to an illustrative embodiment shown in the drawing. In the drawing:

Fig. 1 shows, diagrammatically, the retaining device according to the invention in combination with a separate cable store; and

Fig. 2 shows a bottom view of the retaining device according to the invention; and

Fig. 3 shows, diagrammatically, the retaining device according to another variant of the invention in combination with a separate cable store.

In Fig. 1 the retaining device according to the invention is indicated by 1. This consists of a drum 2 that is driven by a motor 10 and brake/locking system 20 and 21. The bearing for the construction is indicated by 9 but it will be understood that any other bearing can be used. Drum 2 is of circular cylindrical construction with an axis 11. The

circular cylindrical storage drum 14 with an axis 12 is fixed on top of drum 2. In the illustrative embodiment shown the axis of the storage drum 14 is coincident with axis 12. However, it is also possible to position this eccentrically like drum 2.

The axis of rotation of the drive shaft 8 of motor 10 is indicated by 12. It can be seen from Figs 1 and 2 that the axes of rotation 11 and 12 are offset with respect to one another. On the casing face 13, the drum 2 is provided with peripheral grooves 3 for accommodating two windings of cable 4.

5 indicates a cable guide that can be moved up and down in the direction of arrow 6 in order to guide the cable into the groove in the correct manner or to guide the cable from the drum 2 to the storage drum 14 and vice versa. A rim 20 on which, highly diagrammatically, a brake block 21 can engage extends downwards from the bottom part of drum 2.

In Fig. 2 the drum is shown in the position in which the highest tensile force can be delivered. It can be seen that the axis 12 is essentially coincident with the casing face 13, so that the maximum pulling or paying out force can be exerted on the cable 4 with the aid of a motor 10.

Another variant of the invention with a separate storage drum 7 is shown in Fig. 3. The cable 4 first runs round the circular cylindrical drum 2 with axis 11, then a number of layers around the circular cylindrical part with axis 12 and then continues to the separate storage drum 7. In the illustrative embodiment shown the axis of the top drum is coincident with axis 12. However, it is also possible to arrange for this part to be coincident with axis 11; the cable then runs a number of windings around an eccentric drum and then continues to the separate storage drum 7. Moreover, it is possible to move motor 10 for driving storage drum 7. Drum 2 is driven by driving storage drum 7.

Clear variants will be apparent to those skilled in the art on reading the above; these are in particular dependent on the use of the retaining device. Such variants fall within the scope of the appended claims.